

most important alimentary substances used by man. The modes of their origin and transformation, first within the organism which produces them, and then within the organism which assimilates and consumes them, have been the subject of innumerable inquiries and of endless speculation. Comparatively simple in composition, their true nature and constitution long remained shrouded in apparently impenetrable mystery, and all the methods which chemists were in the habit of employing in the attempt to unravel the internal structure of bodies were in their case unavailing. This was no doubt due in large measure to their limited range of chemical activity, and the relatively small number of combinations and derivatives which could be obtained from them. Even when, by more or less drastic treatment, they were forced to yield other products, the few compounds so formed were products of small molecular weight and of simple constitution, evidently "degradation" products far removed in structure from the parent molecule, and incapable of affording any valid clues to its real nature.

In the work before us it will be seen how all this has been changed. Incidentally Prof. Fischer has gathered together all that has been accumulated respecting this large and important group, and, proceeding to attack in detail its individual members, he has succeeded, by a masterly series of researches extending over nearly a quarter of a century, in laying bare the internal structure of many of the more important constituents of the group and in exposing their genetic relations. The greater bulk of the volume consists of reprints of papers, contributed for the most part to the *Berichte* of the German Chemical Society either by Prof. Fischer, by him in collaboration with his pupils, or by certain of them alone working under his inspiration and direction. The memoirs on the sugars alone number ninety-three. In addition there are seven papers on the ferments. It is significant of Prof. Fischer's power and of the influence of the Berlin laboratory as an engine of research that a considerable number of his collaborators are English, Scotch, and American. This great wealth of experimental material admits, luckily, of very simple classification, viz. (1) as nitrogen-derivatives of the sugars; (2) the syntheses and configuration of the monosaccharides; (3) the disaccharides; and lastly (4) the glucosides. To the student and the investigator who may follow Prof. Fischer into the territory he has thus opened out, the compilation will be invaluable. He has provided us with a *vade-mecum* which will be indispensable to all who purpose to occupy themselves with what, as the direct result of his own assiduous cultivation, will long remain a fruitful field of inquiry.

Of more general interest, however, are the five introductory memoirs in which Prof. Fischer summarises the outcome of this prolonged experimental research. Two of them—"Syntheses in the Sugar-group"—have already been published as lectures delivered to the German Chemical Society and have appeared in the *Berichte*, and are everywhere regarded as among the classics of contemporary organic chemistry. The third paper has been put together for the purposes of this work. It deals with the

material which has been accumulated since 1894, the year of the preceding lecture. The fourth and fifth papers are of special interest to the physiological chemist and medical man. The former is a reprint of a popular lecture given on the occasion of the celebration of the founding of the German Military Medical Academy (1894), and the latter is a contribution to the *Zeitschrift für physiologische Chemie* (1898), and is of particular importance as summarising the work then done on the action of enzymes, and more particularly the enzymes of yeast, upon the hydrolysis and fermentation of the polysaccharides.

The work before us is characteristic of much that we admire in Germany and of much that we deplore in our own country. With the possible exception of America, nowhere else in the world would such a monumental work have been possible. Prof. Emil Fischer, in the Prussian capital, worthily carries on the traditions founded by the Roses, by Mitscherlich, and by Hofmann, aided by all the material appliances which a wise liberality places at his disposal. Economically and financially Germany is even in a "tighter place" than we find ourselves to-day, but she is sufficiently wise to perceive that to starve her educational agencies and to cramp and hinder the development of her schools of research, and thereby interfere with the development of her material resources, is not a sane method of combating her difficulties. But every nation has a Government as good as it deserves. What is possible in Germany is possible only by the attitude of its people towards science and research, and what that attitude is is sufficiently indicated by the circumstance that a German publisher is willing to take the risk of issuing to the German public this memorable series of works, so strikingly characteristic of German capacity, energy, and thoroughness, and of which the volume under review forms a fitting crown and consummation.

T.

THE "VALDIVIA" EXPEDITION.

Die Grundproben der "Deutschen Tiefsee-Expedition." By Sir John Murray and Prof. E. Philippi. Pp. 80-206; with 7 plates and 2 maps. (Jena: Gustav Fischer, 1908.)

THIS valuable monograph forms the fourth part of the tenth volume of the scientific results of the voyage of the German exploring ship *Valdivia* in the Atlantic and Indian Oceans, made during the years 1898-9. These admirable volumes are published under the editorship of Prof. Chun, the zoologist of Leipzig, who was leader of the expedition; and Prof. E. Philippi has secured the valuable cooperation of Sir John Murray, whose wide experience in researches of this class has proved of the greatest service. Prof. Philippi gratefully acknowledges the assistance he received at the *Challenger* office in Edinburgh from the members of the staff, as well as from Sir John Murray himself.

The route taken by the *Valdivia* was round the north of the British Islands, and thence southward, following, at some distance, the western coasts of Europe and Africa; from the Cape of Good Hope a

course southward was taken, until a latitude of 64° was reached; from that point the line taken was by Kerguelen Island to Sumatra, and thence by Ceylon and the East African coast to the Suez Canal. This route was sufficiently different from that of the *Challenger* and other exploring expeditions to supply much new and important evidence, in the 217 soundings and dredgings, concerning the contours of the floors of the Atlantic and Indian Oceans, and the deposits that cover them.

The nature of the materials brought up at various points during the voyage is well illustrated by a series of fine plates, similar to those accompanying the *Challenger* volumes. The globigerina ooze from different latitudes in the two oceans is represented by four very beautiful figures; the pteropod, radiolarian, and diatomaceous oozes, with the glauconite and coprolitic muds, have eight excellent figures devoted to them. Interesting points of difference from the deposits figured in the *Challenger* volume may be noticed on a careful comparison, though the general features are the same.

Of greater interest, however, than the organic deposits are the components of these oozes which are of mineral origin. No trace was found of any particles to which an extra-terrestrial origin could be assigned, neither particles of nickel-iron nor chondritic fragments occurring. A discussion is given of the mode of transport of the mineral fragments—by ice, wind, volcanic eruptions, and currents—and of the alternation of these deposits as proved by the soundings. In addition to the accounts of the glauconite, phillipsite, palagonite, and manganese nodules, of which some interesting particulars are given, we have in this monograph much valuable information concerning materials occurring at the bottom of the deep oceans, previously very imperfectly described or not known at all.

Besides the nodules containing up to 36 per cent. of calcium phosphate from the Agulhas Bank, a blue coprolitic mud is described from near the mouth of the Congo, at a depth of 214 metres, which contain numerous small, oval, phosphatic masses, believed by Sir John Murray to be the excrement of echinoderms. Among the concretions from the Agulhas Bank were found nodules containing 33 per cent. of calcium carbonate, 28 of calcium phosphate, 14.6 of calcium sulphate, and 4.8 of magnesium carbonate, with some ferric oxide, alumina, and silica. These nodules were dredged at a depth of 155 metres.

Perhaps the most interesting and suggestive, certainly the most novel, portion of this memoir is that which deals with the exploration of the "Seine Bank," a portion of the sea-bottom lying north-east of Madeira, which rises with steep slopes from depths of more than 4000 metres to within 146 metres of the surface of the ocean. This bank was first discovered in 1882 and 1883 by the cable steamers *Seine* and *Dacia*.

The calcareous sand dredged from the bank in question, at a depth of 150 metres, was found to be made up of fragments of Bryozoa, corals, and hydroid polyps, and shells and pteropods and other mollusca, spines, and plates of echinoderms, various Foraminifera, spicules of alcyonarians and sponges

with fragments of crustaceans and otolites of fish. The inorganic constituents consisted of fragments of pumice and felspar.

The chemical analysis of different samples of this calcareous sand by Herr Pillow, of Berlin, revealed the interesting fact that the material had undergone a greater or less amount of dolomitisation. The several analyses gave percentages of 11.11, 14.36, 17.28, and 18.17 of magnesium carbonate, with a small amount, in some cases, of calcium phosphate. The study of thin sections of the material, stained by Lemberg's solution, showed that the dolomitisation was most marked in the calcareous mud, in which the fragments of organisms were embedded, but had also commenced in the latter themselves. Sometimes as much as nine-tenths of the cementing matrix of the deposit was found to be converted into the characteristic rhombohedra of dolomite.

The similarity of these results with those obtained by the study of the materials sent home by the Funafuti expeditions is very striking. The proportion of magnesium carbonate in the Seine-Bank material does not greatly exceed what is found in many organic deposits in which a gradual leaching out of the calcium carbonate appears to have taken place. It is interesting to notice that the depth of the deposits of the "Seine Bank" is only about 500 feet, and at this depth the chemical changes in question may be assumed to have taken place. The conditions under which the dolomitisation of limestones is brought about are still very obscure, but the facts described in the present memoir, with those contributed by Högbom, Natterer, Nichols, and other observers, are valuable contributions towards the solution of the problem.

Another interesting discovery was made in the South Atlantic Ocean in soundings, where the globigerina ooze was found to graduate into the red clay at a depth of 5040 metres. In the mixture of clay and calcareous ooze there were found numbers of minute, clear yellow crystals, which were shown by Prof. Linck to be the fundamental rhombohedra of calcite without any trace of magnesium carbonate. We seem to have evidence here that, at depths at which solution of calcareous organisms is going on, the dissolved matter may, under certain conditions, be re-deposited as calcite.

The whole of the memoir before us, indeed, abounds with facts and suggestions that cannot fail to be of great service in the solution of the problem of the chemical operations going on at various depths in the ocean—a problem which as deeply interests the geologist as it does the geo-physicist. J. W. J.

THE GEOLOGICAL SOCIETY OF GLASGOW.

History of the Geological Society of Glasgow, 1858–1908, with Biographical Notices of Prominent Members. Edited by P. Macnair and F. Mort. Pp. v+303. (Glasgow: Published by the Society, 1908.) Price 6s. net.

THE city of Glasgow, situated in the midst of a busy coal- and iron-mining district, within easy reach of the Highlands, the Western Isles, and the Southern Uplands, all replete with fascinating and